SECTION 63

EXHAUST AND UPTAKE SYSTEMS

63.1 REFERENCES

(63A) **VOLUME V**, *OWNER - FURNISHED EQUIPMENT*

63.2 INTRODUCTION

This Section contains the Contractor Design and Provide general requirements for the exhaust systems necessary to support Vessel machinery.

For WSF Fleet-wide Standardization purposes, End No. 1 of the Vessel shall always be considered the bow, and this designation shall delineate port and starboard, fore and aft wherever they are addressed in the Technical Specification.

63.3 GENERAL

All silencers will be furnished by the PSI and SSDG Contractors (i.e. Owner - Furnished Equipment (OFE)). Installation and all other exhaust system foundations and components shall be provided by the Contractor.

The Contractor shall install the exhaust systems specified herein. Each Main, Ship's Service Generator, and Emergency Diesel Generator engines; and the Oil-fire Hot Water Heater shall exhaust through a separate pipe within the casing and funnel.

All engine and the oil-fired hot water heater manufacturers' backpressure limits shall not be exceeded in any installation. All design calculations, including developed minimum exhaust pipe sizes, anticipated pressure losses, anticipated back pressures, expansion joint and flange loading, anticipated thermal expansion and engine excursion at each support point, and the anticipated load at each support point shall be submitted for approval as required in Section 100 of the Technical Specification.

Triple-walled, round, stainless steel flexible connections (expansion joints) shall be installed near each engine and Oil-fired Hot Water Heater exhaust/uptake to allow for vibration and thermal and resilient mount deflections. Additional flexible connections shall be installed as required to accommodate deflection and thermal growth throughout the systems. Flexible connections shall be the type indicated in Section 74 of the Technical Specification.

Hangers, anchors and guides shall allow for thermal growth in the exhaust piping and shall isolate heat, noise, and vibration from the Vessel's structure.

Materials and installation shall be in accordance with Section 74 of the Technical Specification.

Ensure that all exhaust runs are sloped so that no concentrated volume of liquid can accumulate.

Weather closures shall be provided where the tail pipes pass through the funnel top plate to prevent water from entering the Fidley area.

Provide easy access for all maintenance, removal, and replacement of expansion joints, valves, gaskets, hangers, and soot pots without the necessity of hot work.

63.4 MAIN DIESEL ENGINES

The Main Engines exhaust systems shall be designed and installed. Material shall be as specified in Section 74 of the Technical Specification. The Contractor shall provide the complete exhaust systems (except OFE exhaust silencers) including flanged exhaust pipe adapters, reducers, pipe, fittings, expansion joints, valves, flanges, gaskets, hangers, foundations, and other items and devices as are required to make complete, functional, and fully operational exhaust systems.

The exhaust silencers will be furnished as OFE in accordance with Reference (63A) and will have spark arresting capability and soot pots. The silencers shall have low-point drains installed to drain any oil or water accumulations. The drain pipes shall be capped and allow for a water bucket to be placed under the open end. The Contractor shall design and provide, WSF approved, removable stainless steel watertight containers for each silencer which will fit under the soot pot clean-outs and sized to contain the debris from cleaning each soot pot, have attached handles for removal, and be easily accessible from outside of the insulation blankets to allow for the cleaning of soot pots.

The diesel engine exhaust systems and design shall satisfy all the requirements of the diesel engine manufacturer as to pipe size, bends and other restrictions, such as turbocharger exhaust flange loading, in order to ensure that diesel engine performance and long life is not compromised. The Contractor shall obtain engine manufacturer concurrence with the design, prior to submitting the construction drawings to WSF for approval. A suitable stainless steel, removable rain cap, with handles, shall be provided for each exhaust outlet.

The exhaust piping shall be so arranged and supported as to safely withstand stresses induced by weight, thermal expansion, diesel engine displacement and Vessel motion.

Particular attention shall be given to the fact that the diesel engines will be provided with a resilient mounting system when selecting expansion joints. The exhaust expansion joints shall be multi-ply, Type 316 stainless steel, with a Schedule 10 single liner, manufactured by BROOMFIELD'S MARINE EXHAUST Inc. (5104 Ballard Ave. NW, Seattle, WA 98107, (206) 784-9267), or equal. The exhaust piping shall be fitted to allow all Main Diesel engine exhaust expansion joints on all four (4) Vessels of this Contract to be interchangeable without the need for piping modifications from Vessel to Vessel. Provide all engineering data requested by the expansion joint manufacturer so that the manufacturer can design and fabricate the most suitable joint.

63.5 SHIP'S SERVICE AND EMERGENCY DIESEL GENERATORS

The three (3) Ship's Service and one (1) Emergency Diesel Generator's exhaust systems shall be designed and provided by the Contractor. Material shall be as specified in Section 74 of the Technical Specification. The Contractor shall provide the complete Ship's Service and Emergency Generator diesel engine exhaust systems, except Owner - Furnished Equipment (OFE) exhaust silencers, including flanged exhaust pipe adapters, reducers, pipe, expansion joints, valves, fittings, flanges, gaskets, hangers, foundations, and other items and devices as are required to make complete, functional, and fully operational exhaust systems.

The exhaust silencers will be furnished as OFE in accordance with Reference (63A). The silencers shall have low-point drains installed to drain any oil or water accumulations. The drain pipes shall be capped and allow for a water bucket to be placed under the open end. Position the silencers in such a way that the spark boxes and clean-outs are easily accessible.

The diesel engine exhaust systems and design shall satisfy the requirements of the diesel engine manufacturers as to pipe size, bends and other restrictions, such as turbocharger exhaust flange loading, in order to ensure that diesel engine performance and long life is not compromised. The Contractor shall obtain the diesel engine manufacturer's concurrence with its design prior to submitting the construction drawings to the WSF Representative for approval. A suitable stainless steel, removable rain cap, with handles, shall be provided for each exhaust outlet.

The exhaust piping shall be so arranged and supported as to safely withstand stresses induced by weight, thermal expansion, diesel engine displacement and Vessel motion.

When selecting expansion joints, particular attention shall be given to the fact that the diesel engines will be provided with a resilient mounting system. The exhaust expansion joints shall be multi-ply, Type 316 stainless steel, with a Schedule 10 single liner, manufactured by BROOMFIELD'S MARINE EXHAUST Inc. (5104 Ballard Ave. NW, Seattle, WA 98107, (206) 784-9267), or equal. The exhaust piping shall be fitted to allow all Ship's Service diesel engine exhaust expansion joints on all four (4) Vessels of this Contract to be interchangeable without the need for piping modifications from Vessel to Vessel. Provide all engineering data requested by the expansion joint manufacturer so that the manufacturer can design and fabricate the most suitable joint.

63.6 OIL-FIRED HOT WATER HEATER

The Oil-fired Hot Water Heater uptake shall be designed and provided from material as specified in Section 74 of the Technical Specification. The uptake shall be gas-tight with a back pressure not exceeding manufacturer's requirements. The uptakes shall be sized in accordance with ASHRAE standards. All calculations shall be done using the construction drawings, and submitted to the WSF Representative with the drawings for approval. A suitable stainless steel, removable rain cap, with handles, shall be provided for the uptake outlet.

Provide stainless steel metal expansion joints at the outlet of the Oil-fired Hot Water Heater uptake and elsewhere as required to accommodate the Oil-fired Hot Water Heater and uptake thermal expansion. The location and quantity of expansion joints shall be adjusted to suit the Contractor's calculations.

The Oil-fired Hot Water Heater uptake shall be arranged and supported to withstand stresses induced by weight, thermal expansion and Vessel motion outlined in Section 1 of the Technical Specification. The uptake expansion joints shall be multi-ply, Type 316 stainless steel, with a Schedule 10 single liner, manufactured by BROOMFIELD'S MARINE EXHAUST Inc. (5104 Ballard Ave. NW, Seattle, WA 98107, (206) 784-9267), or equal. The uptake piping shall be fitted to allow all uptake expansion joints on all four (4) Vessels of this Contract to be interchangeable without the need for piping modifications from Vessel to Vessel. Provide all engineering data requested by the expansion joint manufacturer so that the manufacturer can design and fabricate the most suitable joint.

63.7 INSULATION AND LAGGING

Provide insulation and lagging in accordance with this Section and Section 75 of the Technical Specification.

Where the insulation is subject to damage, the lagging shall be protected by a sheet metal covering.

Removable pads shall be provided over flanges, flexible joints, and connections.

The exhaust piping systems shall include guards located where high operating surface temperature may create a hazard to personnel.

63.8 CLEANING

The turbo charger and/or exhaust outlets from all diesel engines, and the uptake for the Oil-fired Hot Water Heater shall be blanked off during system construction. The exhaust/uptake systems piping, including fittings, shall be cleaned of all foreign matter after fabrication and assembly. All turbo chargers and/or exhaust/uptake outlets shall be presented to, and visually checked for debris and verified by the WSF Representative and the Staff Chief Engineer **before** engine or Oil-fired Hot Water Heater start-up.

63.9 SPARE PARTS AND INSTRUCTION MANUALS

Provide a list of recommended spare parts and special tools for those items which are Contractor furnished, together with parts lists and instruction manuals necessary to maintain and service provided equipment and accessories in accordance with the requirements of Sections 86 and 100 of the Technical Specification.

63.10 TESTS, TRIAL AND INSPECTIONS

Test and/or trials shall be provided in accordance with this Section and Section 101 of the Technical Specification.

Inspections shall be performed as defined in this Section and Section 1 of the Technical Specification.

63.11 PHASE II TECHNICAL PROPOSAL REQUIREMENTS

The following calculations, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase II Technical Proposal stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Main Engine Combustion Exhaust System Calculations

B. Ship's Service Diesel Generator Exhaust System Calculations

C. Emergency Diesel Generator Exhaust System Calculations

D. Oil-fired Hot Water Heater Uptake System Calculations

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

63.12 PHASE III DETAIL DESIGN AND CONSTRUCTION REQUIREMENTS

The following calculations, in addition to other deliverables required by Section 100 of the Technical Specification and the Authoritative Agencies, shall be provided during the Phase III Detail Design stage of Work in accordance with the requirements of Section 100 of the Technical Specification:

A. Main Engine Combustion Exhaust System Calculations

B. Ship's Service Diesel Generator Exhaust System Calculations

C. Emergency Diesel Generator Exhaust System Calculations

D. Oil-fired Hot Water Heater Uptake System Calculations

See Section 100 of the Technical Specification for additional requirements regarding technical documentation.

(END OF SECTION)